Regency COMMUNICATIONS, INC.

SERVICE MANUAL

MICRO·COM P SERIES
UHF HAND HELD TRANSCEIVER

MODELS

MICRO·COM P·U401
MICRO·COM P·U404
MICRO·COM P·U201
MICRO·COM P·U204

1227 S. PATRICK DR.
SATELLITE BEACH FL

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TABLE OF CONTENTS

SECTION 5 - ALIGNMENT

SECTION 6 - PARTS LIST

SECTION 1 - OPERATION

1-1 TRANSCEIVER DESCRIPTION

The Regency Micro-Com P Series personal portable radio is an extremely compact, highly reliable two-way frequency modulated (FM) radio designed for operation in the 450-470 MHz frequency range. The MCP-U404 produces 4 watts of power output. Up to four channels are available and may be conveniently switched as required. A separate speaker and microphone are incorporated for better audio quality. The receiver design incorporates features to assure optimum selectivity under congested conditions. A large push-to-talk transmit switch is prominently located on the side of the case such that it may be operated conveniently by the thumb or fingers for right or left hand operation. A line of convenient accessories is available for operation and battery charging.

1-2 POWER/VOLUME CONTROL

(See Figure 2-1). Activating the "VOL/OFF" knob in the clockwise direction applies power to the unit. Counter-clockwise is off. The VOLUME control adjusts the sound level from the speaker. Volume setting does not affect battery drain during squelched (no signal) conditions. If the unit is operated unsquelched and no signal is heard, the volume should be set as low as possible to reduce battery drain. Volume setting does not affect the transmitted signal in any way.

1-3 SQUELCH CONTROL/TONE SWITCH

Proper use of the SQUELCH control prolongs battery life between charges and prevents reception of noise and interference. Rotate the SQUELCH control counter-clockwise, but do not switch the TONE switch. Rotate the VOLUME control clockwise until a "rushing" noise is heard. Rotate the SQUELCH control clockwise to a point just past that in which the background noise is cut off(squelches). This is the normal SQUELCH control setting. Battery life is inversely proportional to the amount of sound coming from the speaker. A low setting of the VOLUME control and keeping the unit "squelched" will produce maximum battery life. If intermittent reception is a problem, rotate the SQUELCH control counter-clockwise. The TONE switch is incorporated as part of the SQUELCH control, but is only operational when optional tone equipment is installed.

1-4 CHANNEL SELECTOR SWITCH

The CHANNEL selector switch is marked with positions 1,2,3 and 4. This allows selection of up to four channels transmit and receive. The switch is rotated for selection of the desired channel.

1-5 MICROPHONE/SPEAKER RECEPTACLE

The MICROPHONE/SPEAKER receptacle is a six pin connector that provides for connection of an accessory speaker/mike (MA-184),wall and mobile chargers.

1-6 PUSH-TO-TALK SWITCH

To transmit, depress the PUSH-TO-TALK switch completely and hold. To receive, release the switch completely.

1-7 MICROPHONE

The MICROPHONE is located below the center of the speaker grill. While transmitting, speak into the microphone grille in a normal voice from one to two inches away.

1-8 OPERATION AT EXTENDED RANGE

To increase range between units, the following has been found effective:

(a) Orient the antenna vertically.
(b) Rotate SQUELCH control counter-clockwise allowing some background noise to be heard.
(c) Move unit away from shielding caused by nearby buildings.
(d) Elevate the unit as high as possible over the surrounding terrain.
(e) Speak slowly and distinctly into the MICROPHONE or accessory SPEAKER/ MICROPHONE with your lips about one inch from the grille; do not shout.
(f) Be sure the unit has fully charged batteries.

1-9 ON CHANNEL INTERFERENCE

You might notice that stations in other nearby systems use your frequency. If the stations are quite weak and stations in your system relatively strong, you might be able to adjust the SQUELCH control on your unit to reduce the number of calls heard from stations in the other system. Use of TONE controlled squelch in your system can eliminate interference from other systems.

1-10 OPERATIONAL PRECAUTION

Reception of excessively strong signals may cause damage to the receiver. Use of this unit in close proximity to a base station antenna or closer than twenty inches from another unit is not recommended. Transmission without the antenna may cause damage to the transmitter. An antenna or a dummy load should always be connected to the ANTENNA receptacle before transmitting.

1-11 BATTERY INFORMATION

New batteries will normally reach full charge in 5 hours. Use of the MA-185 Desk Top Charger, Ma-196 Wall Charger or MA-195 Mobile Charger is recommended. Normal charge rate is 110mA. Never exceed a 150mA charge rate.

1-12 BATTERY CONDITION INDICATOR

The LED battery condition indicator will glow during transmit with a brightness proportional to battery voltage. When battery voltage drops to less than 9 volts, the LED will not glow, thereby indicating that charging is necessary.

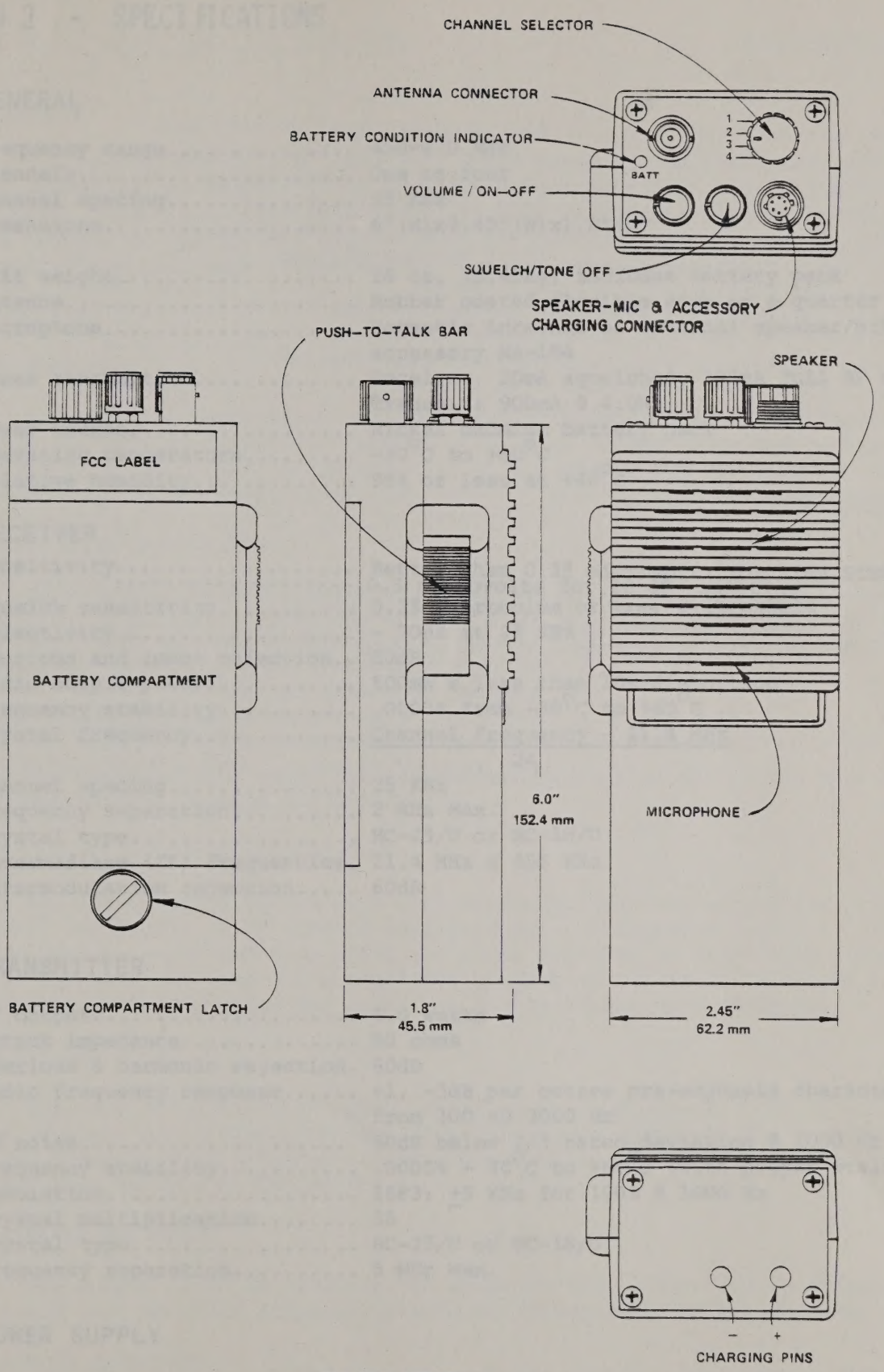
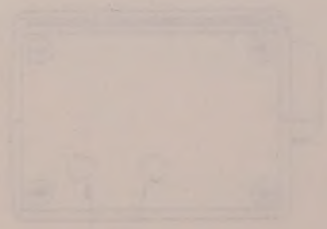

CHANNEL SELECTOR
ANTENNA CONNECTOR
BATTERY CONDITION INDICATOR
BATT
VOLUME / ON–OFF
SQUELCH/TONE OFF
SPEAKER-MIC & ACCESSORY CHARGING CONNECTOR
PUSH–TO–TALK BAR
SPEAKER
FCC LABEL
BATTERY COMPARTMENT
BATTERY COMPARTMENT LATCH
6.0"
152.4 mm
MICROPHONE
1.8"
45.5 mm
2.45"
62.2 mm
CHARGING PINS

FIGURE 2-1



SECTION 2 - SPECIFICATIONS

2-1 GENERAL

Frequency range	450-470 MHz
Channels	One to four
Channel spacing	25 KHz
Dimensions	6"(H)x2.45"(W)x1.8"(D)
Unit weight	16 oz. (0.45kg) includes battery pack
Antenna	Rubber coated flexible stub or a quarter wave whip
Microphone	Magnetic internal or external speaker/mike accessory MA-184
Power consumption	Receive: 20mA squelched, 100mA full AF output Transmit: 900mA @ 4.0W
Power source	Nickel cadmium battery pack
Operating temperature	$-30^{\circ}C$ to $+60^{\circ}C$
Relative humidity	95% or less at $+40^{\circ}C$

2-2 RECEIVER

Sensitivity	Better than 0.35 microvolts for 12dB SINAD 0.5 microvolts for 20 dB quieting
Squelch sensitivity	0.25 microvolts or less @ threshold
Selectivity	- 70dB at 25 KHz
Spurious and image rejection	60dB
Audio output power	500mW @ less than 10% distortion
Frequency stability	.0005% from $-30^{\circ}C$ to $+60^{\circ}C$
Crystal frequency	$\frac{\text{Channel frequency - 21.4 MHz}}{24}$
Channel spacing	25 KHz
Frequency separation	2 MHz Max.
Crystal type	HC-25/U or HC-18/U
Intermediate (IF) frequencies	21.4 MHz & 455 KHz
Intermodulation rejection	60dB

2-3 TRANSMITTER

RF output	4.0 watts
Output impedance	50 ohms
Spurious & harmonic rejection	60dB
Audio frequency response	+1, -3dB per octave pre-emphasis characteristics from 300 to 3000 Hz
FM noise	50dB below 2/3 rated deviation @ 1000 Hz
Frequency stability	.0005% - $30^{\circ}C$ to $+60^{\circ}C$ (with proper xtals)
Modulation	16F3: $\pm$5 KHz for 100% @ 1000 Hz
Crystal multiplication	36
Crystal type	HC-25/U or HC-18/U
Frequency separation	5 MHz Max.

2-4 POWER SUPPLY

Power source	10.8 VDC nicad battery pack, 500mAH rating
Current drain	Squelched: 20mA Rated AF out: 100mA
Battery life	8 hours; 5% transmit, 5% receive, 90% standby duty cycle

2-5 ACCESSORIES

MA-181	Rechargeable nicad battery pack
MA-182	Leather carrying case without TTP
MA-184	External speaker/microphone
MA-185	Desk top battery charger
MA-186	Touch-Tone pad (DTMF Encoder)
MA-187	CTCSS Encoder/Decoder
MA-193	TTS Decoder
MA-194	2805 Tone Decoder
MA-195	Mobile charger
MA-196	Portable wall charger
MA-198	Stub Antenna
MA-199	DTMF Decoder

2-6 FEATURES

Physical	Light weight, small ruggedly constructed
Enclosure	High impact LEXAN case
State-of-the-Art design	Silicon transistors throughout, independent voltage regulation for transmitter, solid state antenna switching (no relays), two IF filters, low level audio clipping to prevent over modulation.
Flexibility	External speaker/mike connector, four transmit and receive channels. Uses a Nicad Battery Pack

SECTION 3 - CIRCUIT DESCRIPTION

3-1 GENERAL

The Regency MCP-U is a hand-held, dual conversion superheterodyne UHF frequency modulated transceiver. The transmitter and receiver share a single printed circuit board. The transmitter uses an independent microphone element installed below the speaker on the speaker grille. A panel connector is provided for an external speaker microphone and other accessories.

3-2 RECEIVER

3.2.1 RF AMPLIFIER

Refer to the transceiver block diagram, Figure 3-1, (Page 3). An incoming signal from the antenna is coupled through a low pass filter and a two section helical resonator to Q1. The signal is amplified by Q1 and passes through another two section helical resonator to the first mixer, Q2.

3.2.2 FIRST LOCAL OSCILLATOR

Q6 is a temperature compensated crystal oscillator. The fourth harmonic of the crystal is picked up by T9 and used to drive Q7. The output of Q7 is filtered by a two section helical resonator tuned to the 24th harmonic of the crystal, and then fed to Q2.

3.2.3 FIRST IF AMPLIFIER

The output of the mixer (Q2) passes through a 21.4 MHz filter consisting of YFL-1, T5 and T6, and is then amplified by Q3.

3.2.4 SECOND IF AMPLIFIER AND DETECTOR

The output of Q3 is fed into IC1, which contains the second mixer, the second local oscillator, a 455 KHz IF amplifier and a quadrature detector. The detector output is separated into audio and noise portions by RC filters. The noise portion is fed back into the noise amplifier portion of IC1, and its output is rectified by a diode, (D1) and then fed back into the switching section of IC1.

3.2.5 AUDIO AMPLIFIER

IC2 is a low distortion audio amplifier which produces 500mW of audio output. While the receiver is in squelched condition, the power supply to IC2 is turned off by Q4. The appearance of a signal causes the output of Pin 13 of IC1 to go high and turn on Q5, thus turning on Q4 and IC2.

3.2.6 RECEIVER SWITCHING

The output of Q8 is regulated to about 8 volts. When PTT is pushed to transmit, the base of Q8 is grounded through D3, turning off entire receiver section.

3.2.7 ANTENNA SWITCHING

In the transmit mode, the input of the first helical resonator is grounded by a PIN diode (D4) so that transmit RF power will not feed into the receiver section. In the receive mode, no power is supplied to D4. Its low capacitance characteristic

in the OFF state enables incoming signals to pass through with little loss. The final transistor (Q17) is in the OFF state during receive mode, thus causing most of the incoming signal to take the route through L13 and L12.

3.3 TRANSMITTER

3.3.1 OSCILLATOR AND MODULATOR

Q9 is a temperature compensated oscillator designed to compensate for the characteristic shift of the load capacitance of a crystal. Microphone audio is applied to Mic Amplifiers Q18 and Q19, passed through a limiter (D6 and D7) and fed through a buffer (Q20) and an audio filter. This processed audio is then applied to the phase modulator (Q10).

3.3.2 FREQUENCY MULTIPLIERS

Carrier frequency is obtained with a doubler (Q11), a tripler (Q12), a doubler (Q13) and a tripler (Q14). The output of each section is tuned by High-Q double-tuned coils to assure good harmonic and spurious rejection while maintaining good bandpath quality.

3.3.3 DRIVERS AND FINAL AMPLIFIERS

The (approximate value) 10mW OUTPUT OF Q14 is amplified by Q15, Q16 and Q17. The output of Q17 is then filtered and fed to the antenna.

3.3.4 TRANSMITTER SWITCHING

Q21 is in the OFF state during receive mode. When the PTT is pushed to transmit, Q21 turns on and supplies voltage to all transmitter states except the final. B+ is always present at the final transistor, regardless of the mode or any switch position, since the power switch on the volume control can not handle the current required by the final.

BLOCK DIAGRAM

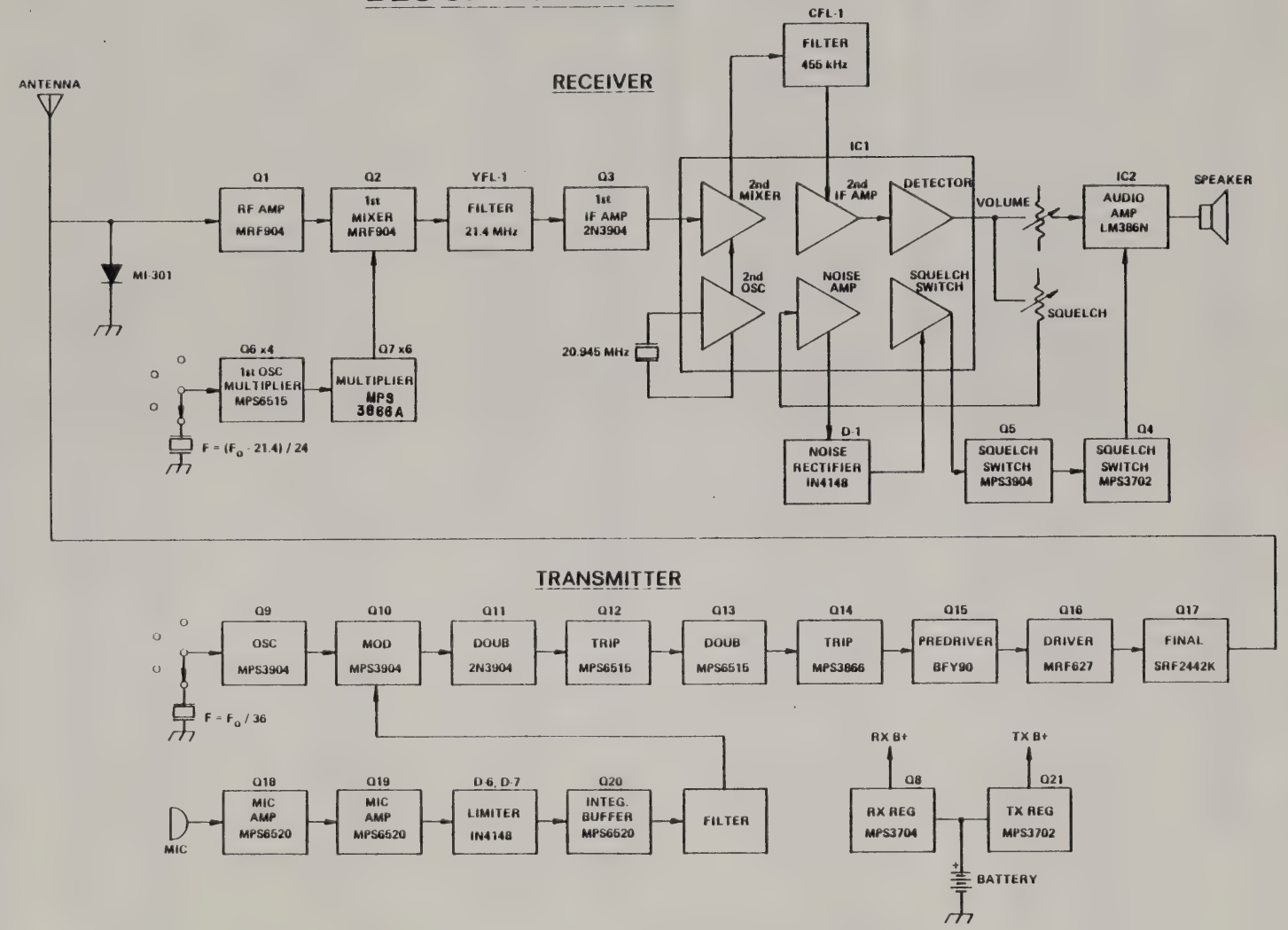


FIGURE 3-1

SECTION 4 - SERVICING

4-1 GENERAL

READ THIS SECTION CAREFULLY BEFORE SERVICING THE TRANSCEIVER

4.1.1 DISASSEMBLY

The Regency MCP-U transceiver consists of a single circuit board which includes transmitter and receiver components. It can be easily disassembled according to Figure 5-3 (Page), however, extra care should be taken not to break any wire or component, especially those along the edges of the board. For easier servicing, the back case and the bottom plate may be disconnected.

4.1.2 GENERAL SOLDERING INFORMATION

The same basic soldering practices used on other printed circuit boards can be implemented. Use a 50 watt temperature controlled soldering iron. Apply the amount of heat that will cause the solder to flow quickly, but do not apply it too long. Use a small soldering tip to prevent solder bridges. Do not apply excess solder. Use a vacuum desoldering device to remove excess solder from the circuit board.

4.1.3 TUNING INFORMATION

Unnecessary tuning wastes valuable servicing time and can actually degrade the performance of a unit if not accomplished by an experienced technician.

Use proper tools only, especially for the slugs in the coil forms. Section 5 includes detailed tuning instructions. Test points referenced are locations on the circuit board only, not Jacks.

4.1.4 PREVENTIVE MAINTENANCE

The transceiver should be put on a regular maintenance schedule, and an accurate record of its performance should be maintained. Important items to check are receiver sensitivity, transmitter frequency, deviation and power output. See Section 5 for detailed performance test.

4-2 SWITCHING MALFUNCTION

4.2.1 To incorporate an external speaker microphone, solid state switching is used in the transceiver. In the event of loss of receive or transmit, check Q8 and Q21. Q8 Emitter is normally high and will go near zero when the PTT is pressed. Q21 Collector will go high when the PTT is pressed, to supply voltage to the transmit section.

4.2.2 Note: If Q8 Emitter voltage does not go near zero when the PTT is pressed, the receiver will remain on and its local oscillator will mix with the transmitting signal, causing spurious emissions. This may occur even though the unit appears to be working normally. Check Q8 and D3 for resolution of this problem.

4.2.3 Q8 has a protection resistor in series with the emitter. In order to supply high current to the transmitter section, Q21 does not employ an emitter resistor. If Q21 is shorted, it exhibits some voltage on receive. This will disable the radio amplifier and cause no receive. Replace Q21.

4-3 RECEIVER MALFUNCTION

4.3.1 GENERAL

The receiver can be divided into Front End, IC IF Amplifier and Audio Circuit.

4.3.2 FIRST LOCAL OSCILLATOR

The first oscillator Q6 can be checked by connecting an RF probe or an oscilloscope to its emitter. If Q7 collector voltage measured at TP6 will go down to about 2 volts when turning to T9, the local oscillator circuit may be working normally. If a spectrum analyzer is available, couple it to the emitter of Q2, and tune T10 and T11. It should exhibit about -15dbM output.

4.3.3 FRONT END AND RESONATORS

Helical resonators can be damaged by moisture inside of them. Do not spray or apply PC board cleaning solution around them. It will cause lack of sensitivity and make them difficult to tune. Do not try to open them unless you are sure of bad resonators.

4.3.4 IF AMPLIFIER

Operation of the IF Amplifier can be checked by feeding a 21.4 MHz signal to the collector of Q2. Loss of IF response can be caused by IC1, Q3 or the 21.4 MHz filter. T8 should be tuned for a clean audio sine wave on an oscilloscope. IC1 can best be tested by checking pin voltages against the voltage chart. If tuning T8 causes an increase in speaker noise level but no 21.4 MHz signal is heard, the 20.945 MHz crystal is probably bad.

4.3.5 AUDIO AMPLIFIER

If audio amplifier IC2 is not working, first check its VCC voltage at PIN 6. Q4 or Q5 can open, causing no power to be supplied to IC2. Check the base voltage of Q5 and see if it will go from 0 to 1 volt by turning the SQUELCH control knob. At the same time, its collector voltage should go from approximatley 10.8 volts to near zero.

4-4 TRANSMITTER MALFUNCTION

4.4.1 GENERAL

The transmitter consists of crystal oscillator, modulator, multiplier and RF amplifier.

4.4.2 OSCILLATOR TEST

Check the line voltage along D8. It must exhibit a stable 6V even when the supply voltage is dropped down to 9 volts. Connect an RF probe to the emitter of Q9 for an oscillation check, or connect a voltmeter to TP1 and shunt the crystal momentarily. If the voltage decreases, the oscillator stage is working normally.

4.4.3 MODULATOR

An inexpensive oscilloscope can be used for fast signal tracing. Follow the setup of Figure 5-1 and trace a signal from the audio generator, through the Mic amps, limiter, Integ. buffer and filter. When the signal is lost, the problem lies in the preceding stage.

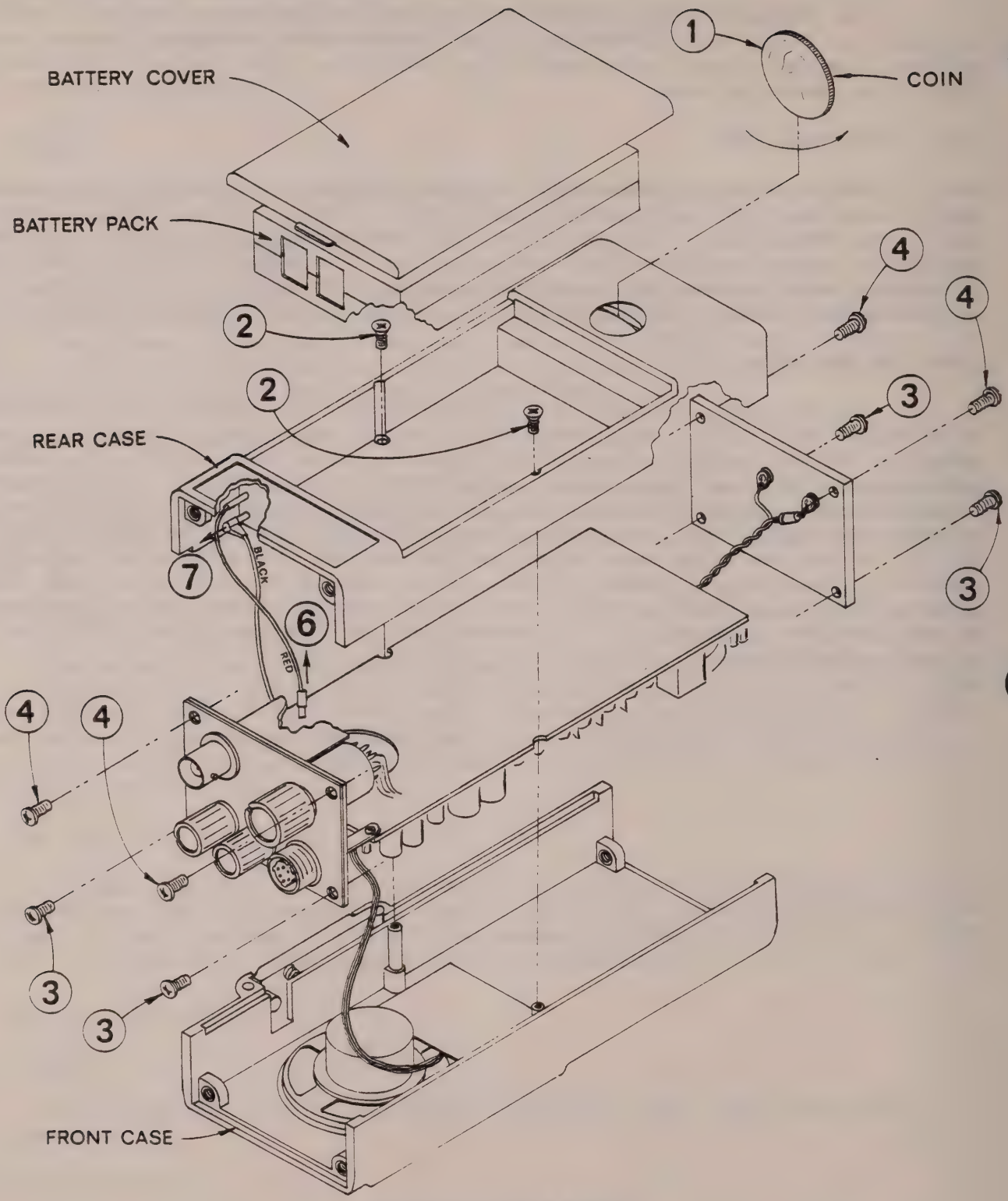
4.4.4 MULTIPLIER TEST

Follow Section 5 transmitter alignment procedure and check voltage relationship between each test point and associated coils. Thus, it can be easily found which coil is malfunctioning. If any coil does not tune properly, check the related tuning, coupling or bypass capacitors, and the coil itself. A defective coupling capacitor may cause a unit to appear to be working normally with tuning slugs at slightly different positions than normal. Generally when this occurs, spurious emissions will be excessive.

4.4.5 RF AMPLIFIER

To check Q15, Q16 and Q17, a straight amplifier section, set up the radio as in Figure 5-1. If the oscillator and all multiplier stages up through Q14 check normally, and the emitter voltage of Q15 rises by tuning TC9 and TC10, you should be able to see an increase in current to about 200mA by tuning TC11. If an increase in current is noted in the preceding step, all of the stages up through Q16 are working normally. By tuning TC12, total supply current should increase to between 500mA and 1A. At the same time power output may be observed on the wattmeter, depending on where TC13(final output trimmer) is set. If an increase in current to 500mA or more is noted when tuning TC12 and TC13, but no power output is observed, the problem lies in the circuitry following Q17. If current does not increase by tuning TC12 and TC13, Q17 may be defective.

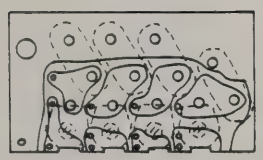
4-5 DISASSEMBLY ILLUSTRATION



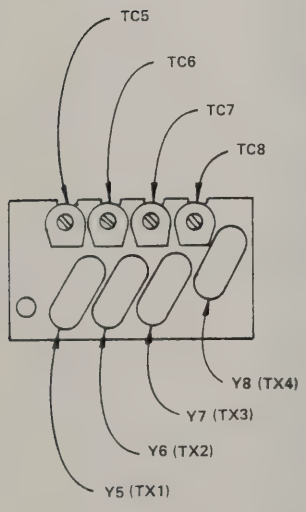
DISASSEMBLY

1. Turn latch with coin, and remove battery cover and battery pack.
2. Remove screws (2) (two places).
3. Remove screws (4) (4 positions).
4. Disconnect (6) and (7)
5. Remove screws (3) (4 positions).

CRYSTAL HOLDER TYPE HC 18/U



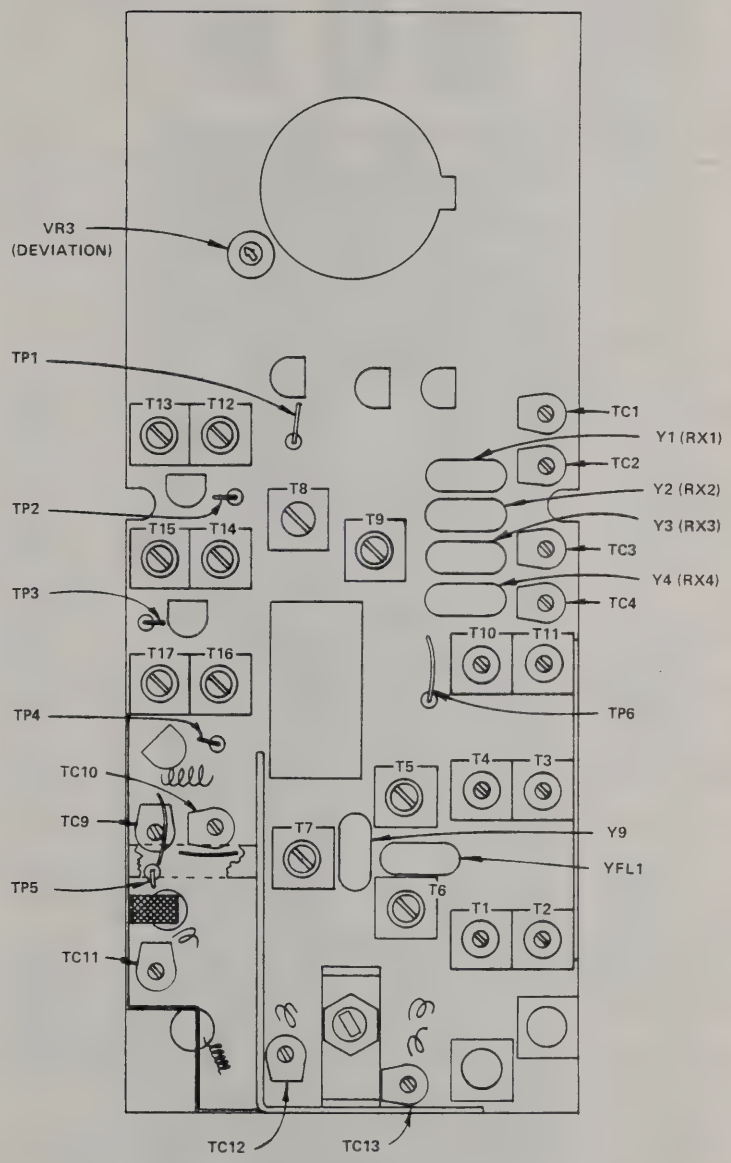
FOIL SIDE



COMPONENT SIDE

CRYSTAL BOARD

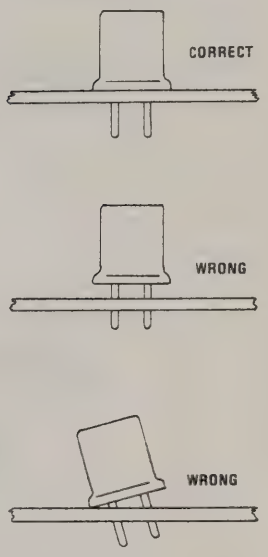
(TOP OF RADIO)



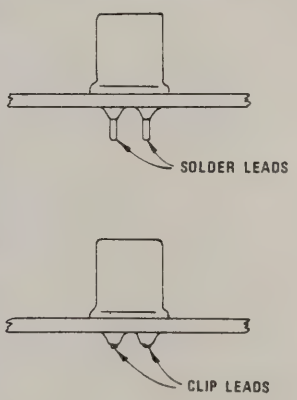
MAIN BOARD

COMPONENT SIDE

NOTE: BASE OF CRYSTAL MUST BE FLUSH WITH BOARD IN ORDER TO FIT INSIDE CASE.



SOLDER CRYSTAL LEADS BEFORE CLIPPING. CLIPPING LEADS BEFORE SOLDERING WILL DAMAGE CRYSTAL.



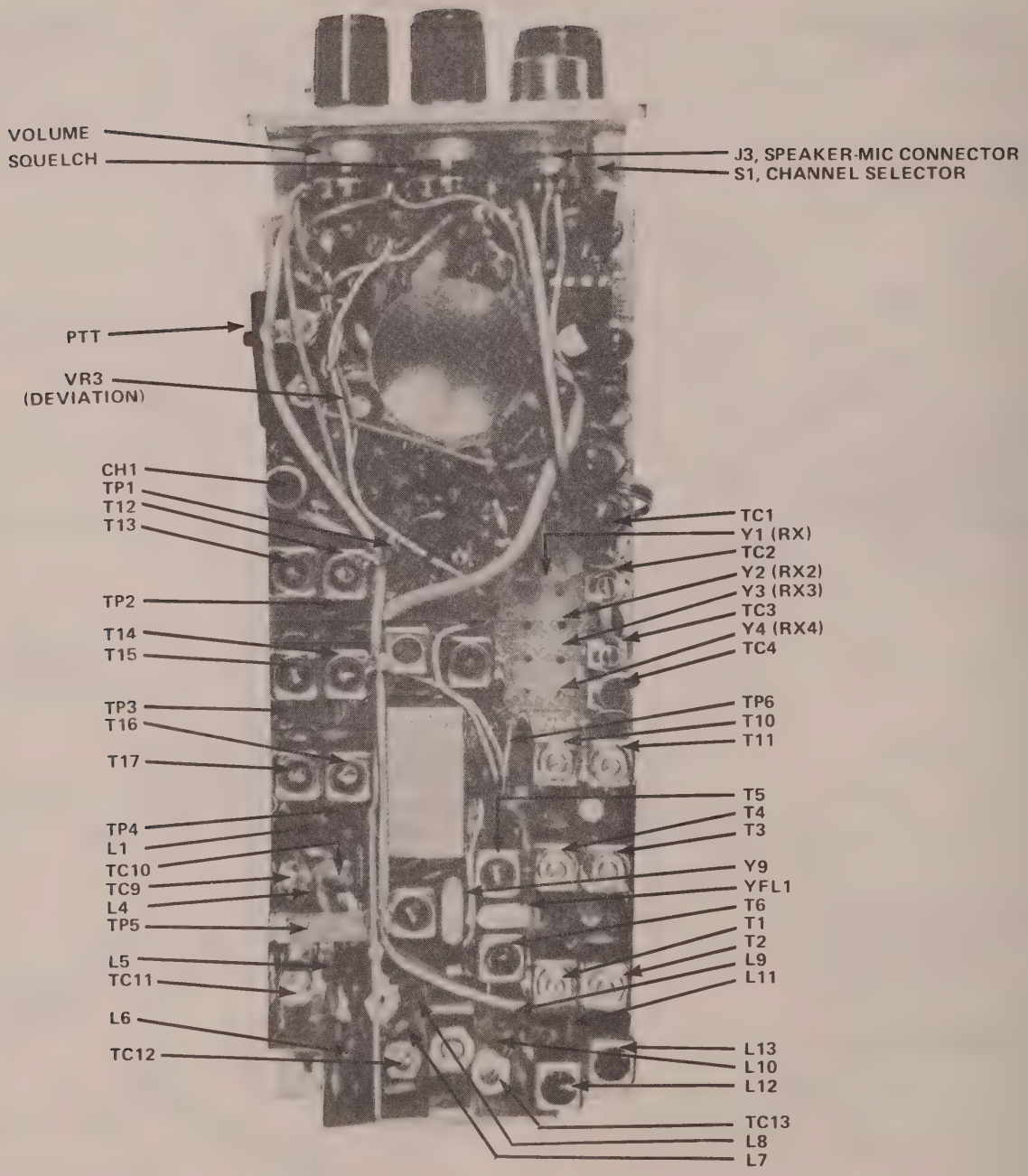
The following formula may be used to determine crystal frequency:

Transmit Freq. = FO/36

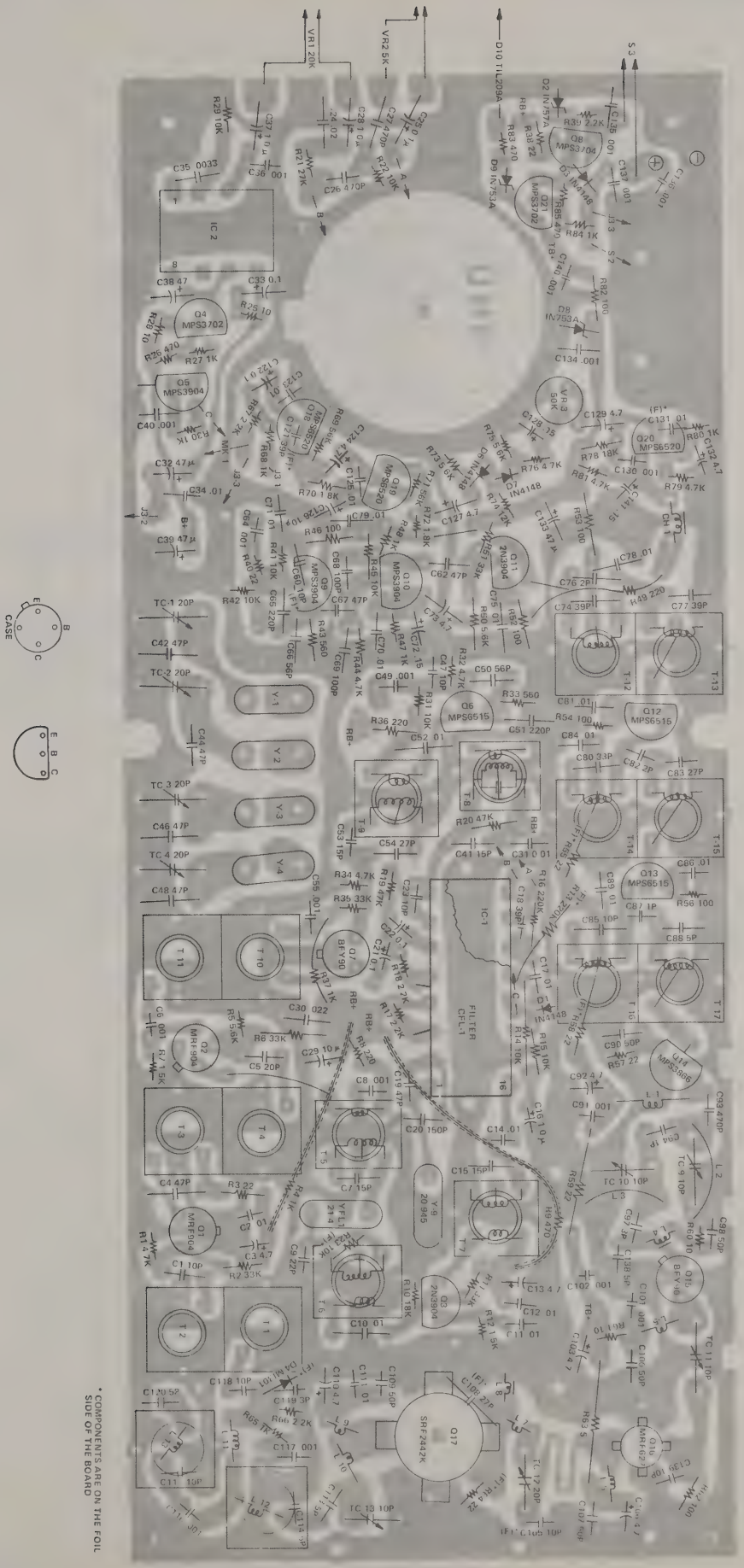
Receive Freq. = (FO −21.4)/24

Both HC18/U holder at cut, 32 pf standard loading crystals.

4-7 PARTS PLACEMENT



4-8 PARTS OVERLAY

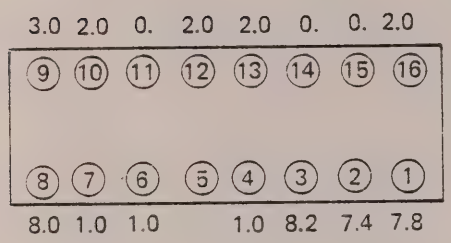


4-9 VOLTAGE MEASUREMENTS

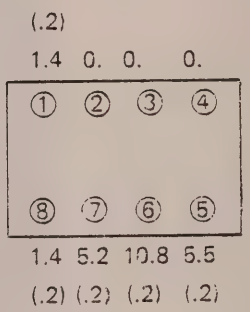
RECEIVER	E	B	C
Q1	0	.8	6.6
Q2	0	1.0	8.0
Q3	1.9	2.5	7.6
Q4	10.9 (.4)	10.0 (11.0)	10.9 (11.0)
Q5	0	.8 (0)	.1 (11.0)
Q6	2.3	2.3	7.0
Q7	0	.4	2.0

( ) means squelch closed

IC1



IC2



SWITCHING	E	B	C
Q8	8.6 (.2)	9.2 (.7)	11.0
Q21	11.0	11.0 (10.2)	0 (10.8)

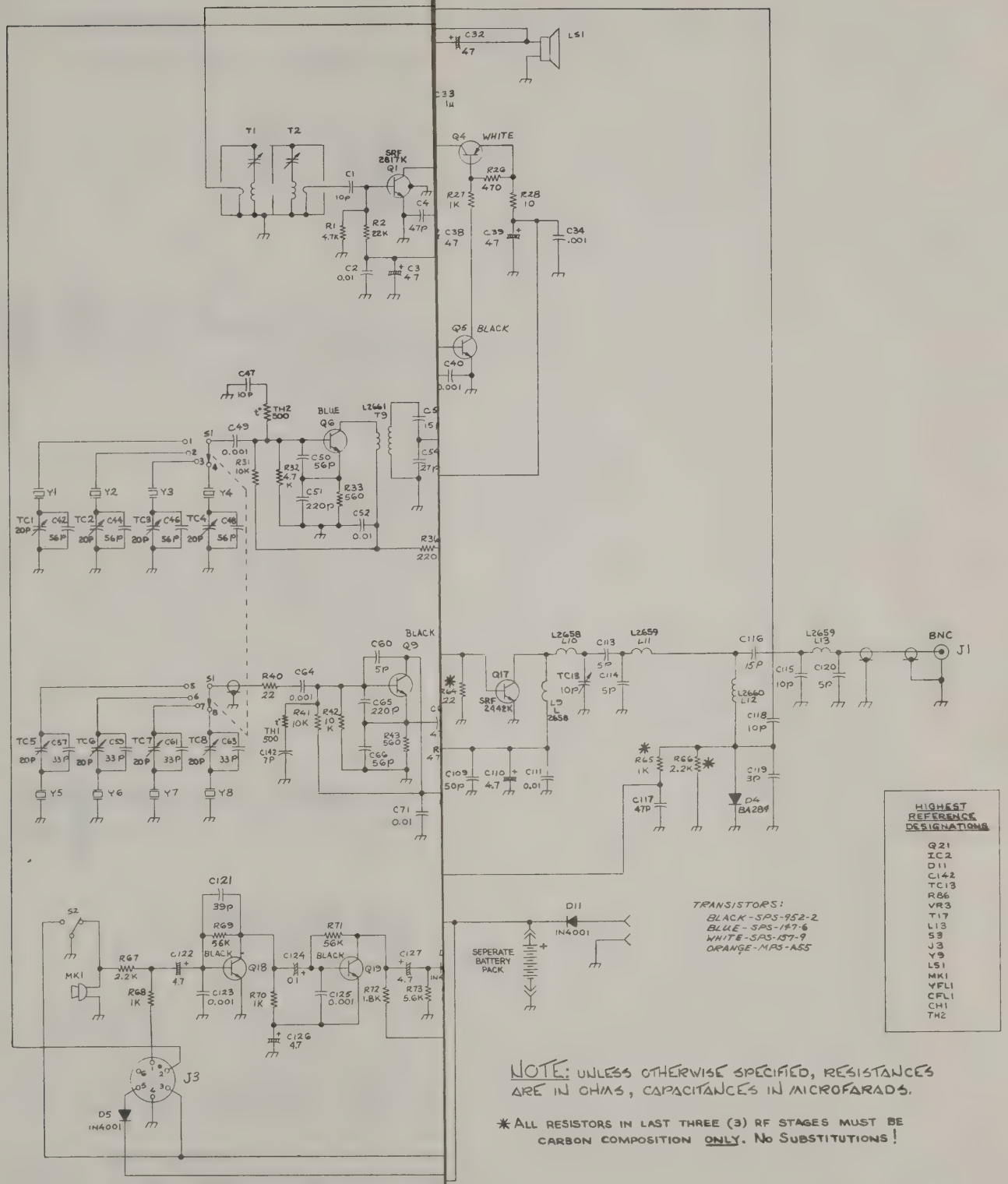
( ) means PTT pushed to transmit

TRANSMITTER	E	B	C
Q9	2.2	2.8	5.8
Q10	1.2	1.8	5.0
Q11	.3	.8	6.0
Q12	1.0	0	6.4
Q13	1.2	0	7.8
Q14	1.0	0	8.4
Q15	.26	0	9.8
Q16	0	−.04	9.4
Q17	0	0	11.0
Q18	0	6	.9
Q19	3.0	3.5	4.0
Q20	.6	1.2	3.2

Transmitter with full power output.

Measurements done by 11.0V supply voltage.

Measured by 50K ohm/V DC voltmeter



NOTE: UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS, CAPACITANCES IN MICROFARADS.

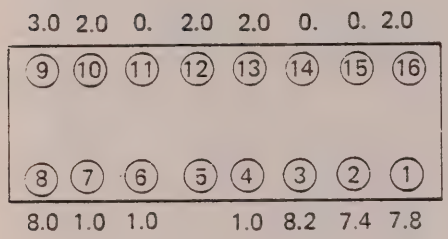
* ALL RESISTORS IN LAST THREE (3) RF STAGES MUST BE CARBON COMPOSITION ONLY. NO SUBSTITUTIONS!

4-9 VOLTAGE MEASUREMENTS

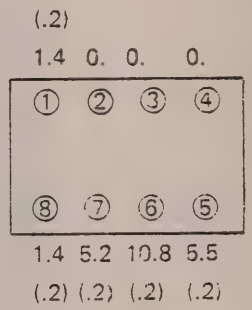
RECEIVER	E	B	C
Q1	0	.8	6.6
Q2	0	1.0	8.0
Q3	1.9	2.5	7.6
Q4	10.9 (.4)	10.0 (11.0)	10.9 (11.0)
Q5	0	.8 (0)	.1 (11.0)
Q6	2.3	2.3	7.0
Q7	0	.4	2.0

( ) means squelch closed

IC1



IC2



SWITCHING	E	B	C
Q8	8.6 (.2)	9.2 (.7)	11.0
Q21	11.0	11.0 (10.2)	0 (10.8)

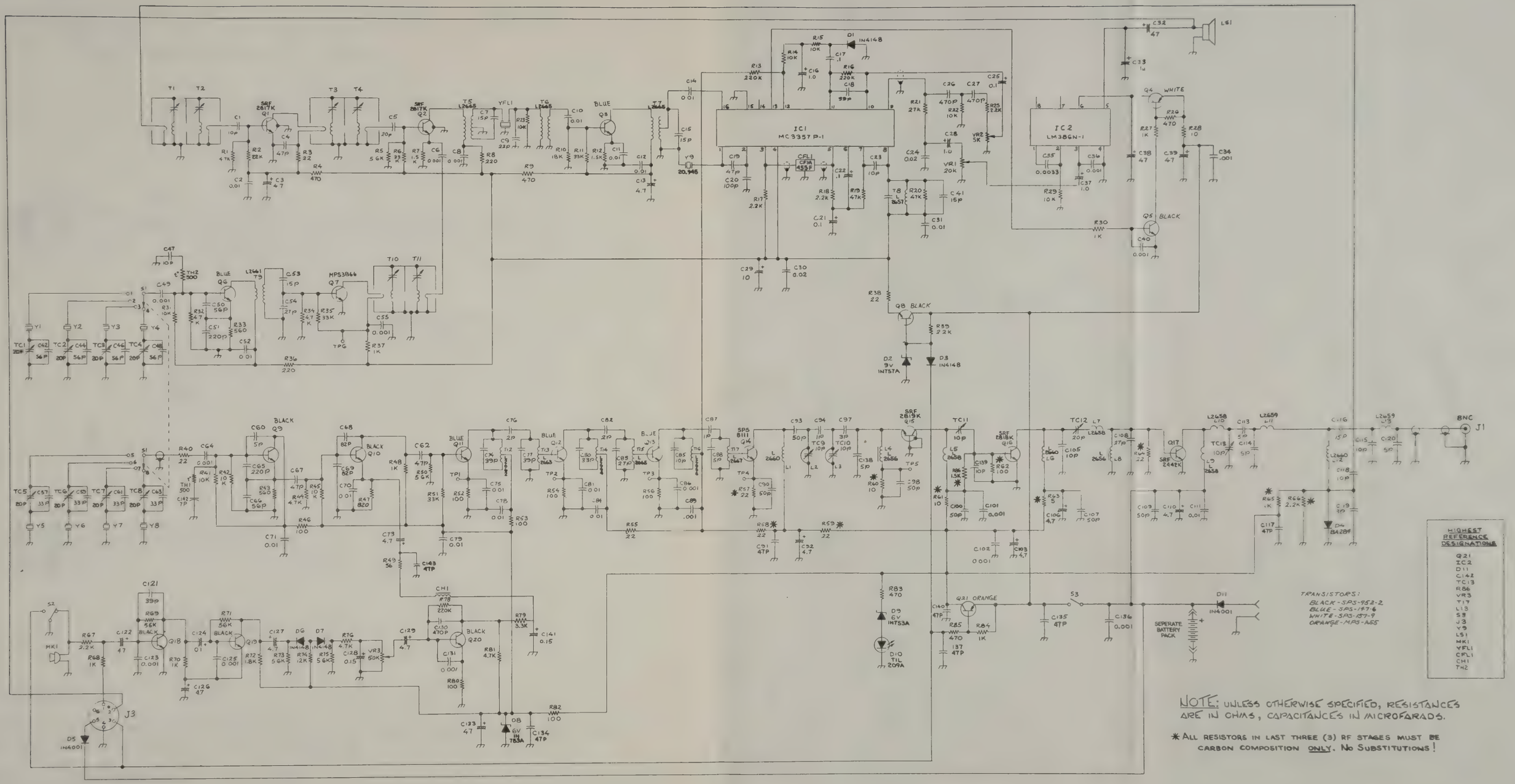
( ) means PTT pushed to transmit

TRANSMITTER	E	B	C
Q9	2.2	2.8	5.8
Q10	1.2	1.8	5.0
Q11	.3	.8	6.0
Q12	1.0	0	6.4
Q13	1.2	0	7.8
Q14	1.0	0	8.4
Q15	.26	0	9.8
Q16	0	−.04	9.4
Q17	0	0	11.0
Q18	0	6	.9
Q19	3.0	3.5	4.0
Q20	.6	1.2	3.2

Transmitter with full power output.

Measurements done by 11.0V supply voltage.

Measured by 50K ohm/V DC voltmeter

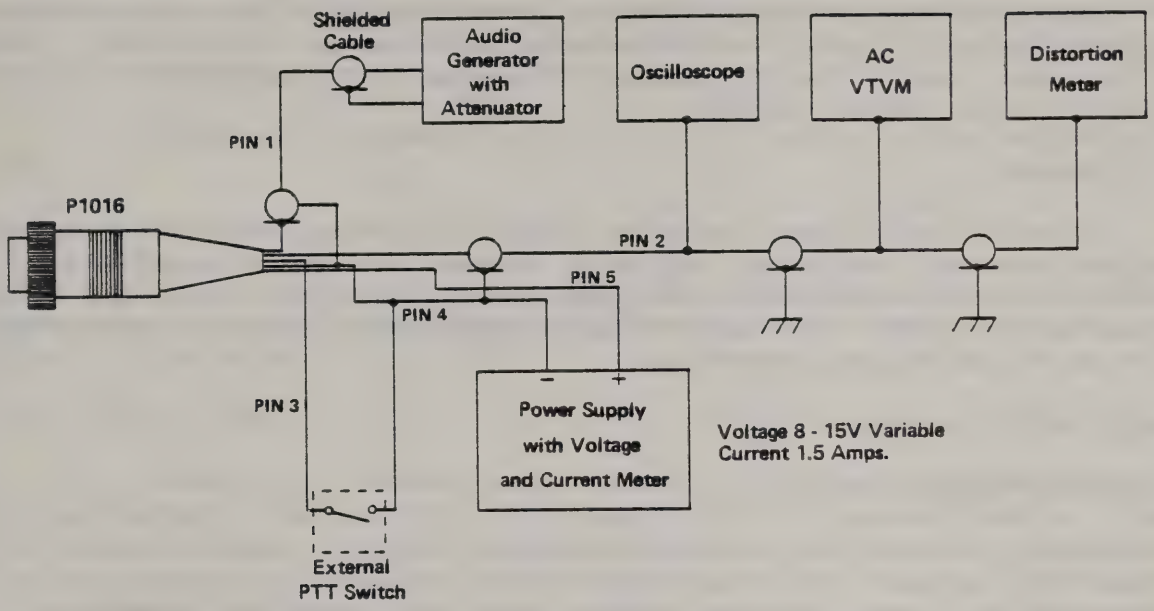

IC1 MC3357P-1
IC2 LM386N-1
HIGHEST REFERENCE DESIGNATIONS
Q21
IC2
D11
C142
TC13
R86
VR3
T17
L13
S3
J3
Y9
LS1
MK1
YFL1
CFL1
CH1
TH2
TRANSISTORS:
BLACK - SPS-952-2
BLUE - SPS-197-6
WHITE - SPS-197-9
ORANGE - MPS-A55
NOTE: UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS, CAPACITANCES IN MICROFARADS.
* ALL RESISTORS IN LAST THREE (3) RF STAGES MUST BE CARBON COMPOSITION ONLY. NO SUBSTITUTIONS!

SECTION 5 - ALIGNMENT

5-1 GENERAL

5.1.1 CONNECTIONS

Connect Test Equipment as illustrated.



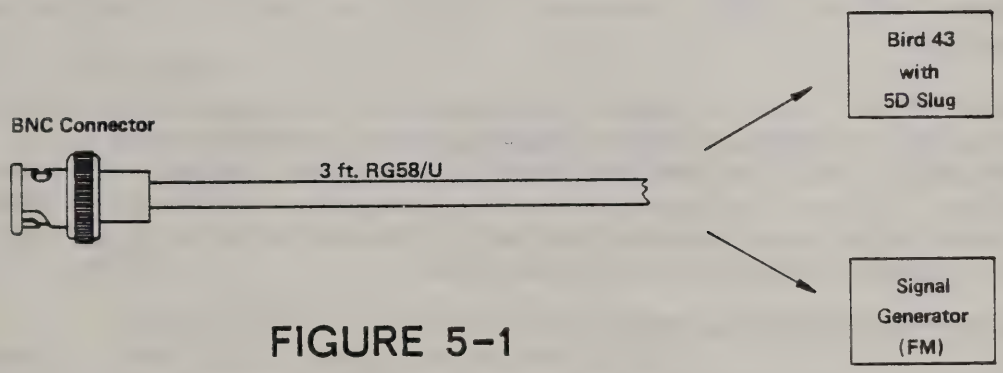


FIGURE 5-1

5-2 RECEIVER

5.2.1 Adjust the squelch control to its maximum CCW position and the volume control just far enough CW to turn the unit on.

5.2.2 Apply power to the unit. Adjust the power supply voltage to approximately 12 volts. Since power is supplied through the Mic connector, there is a voltage drop across protection diode D5. Circuit board voltage should be 11 volts.

5.2.3 LOCAL OSCILLATOR AND MULTIPLIER

Connect a voltmeter set to a 12 volt DC range to TP6. If the receiver crystal is oscillating, a dip can be found by tuning T9. Adjust T9 so that TP6 voltage reads approximately 2 volts. Connect a frequency counter to the emitter of Q6 through a few picofarad capacitor and adjust crystal trimmers to the correct

frequency, which should be (FO-21.4)/24.T10 and T11 can be tuned by connecting a sensitive RF voltmeter or a spectrum analyzer at T11 output, or by the procedure on 5.2.4.

5.2.4 FRONT END TUNING

Set the FM signal generator to the correct frequency and adjust it for a 5 KHz deviation at 1 KHz AF. Set the attenuator for about -60dBM output. Peak T10 and T11 first, then T1 to T4. Gradually turn the attenuator setting down and again peak T1 to T4, and T10 and T11.

5.2.5 IF TUNING

Increase the FM signal generator output by turning up the attenuator till the receiver produces clean audio, and check the wave form on the oscilloscope. If it is not a clean sine-wave, adjust T8 (Quadrature Coil) until a clean sine wave can be seen on the scope. Turn the attenuator back down to about 1µV output and adjust T5 and T6 for minimum distortion.

5-3 RECEIVER PERFORMANCE TEST

5.3.1 QUIETING SENSITIVITY

1. Disconnect the unit from the signal generator and turn squelch control fully CCW. Advance the volume control until the AC-VTVM indicates 1 volt.
2. Reconnect the signal generator (unmodulated) and advance the attenuator till the AC-VTVM reads .1 volt. This should occur at .5µV maximum. (20dB quieting sensitivity).

5.3.2 DISTORTION TEST

SINAD SENSITIVITY: Set the signal generator for .5µV output with 3 KHz deviation at 1 KHz AF. Turn the volume control halfway clockwise. Set the distortion meter range control to the set level position and the range switch to the 30% position. Adjust the input sensitivity control of the meter to read 0dB. Set the range switch to distortion and null 1 KHz adjusting both tuning and null. The meter reading should drop more than 12dB.

5.3.3 AUDIO OUTPUT AND DISTORTION TEST

1. Set the signal generator for 1000µV output with 5 KHz deviation at 1 KHz AF.
2. Set the volume control to produce 2V RMS on the AC-VTVM.
3. Set the meter range switch on the distortion meter to 100% and adjust the input sensitivity control for a full scale reading.
4. Set the range switch to distortion and balance out 1 KHz. The meter should indicate below 10 in the 10% position.

5.3.4 SQUELCH SENSITIVITY

1. Disconnect the signal generator from the unit. Set the squelch control at the threshold. Modulate the signal generator at 1 KHz with 3 KHz deviation and connect to the unit. Turn up the generator output enough to open the squelch. The attenuator reading should be approximately .2 to .3µV.

5-4 TRANSMITTER ALIGNMENT

5.4.1 CONNECTIONS

Refer to Figure 5-1. Connect the antenna cable to a Bird 43 wattmeter terminated with a 50 ohm dummy load. All readings are in transmit mode (PTT keyed).

5.4.2 FIRST DOUBLER

Attach a DC voltmeter set for the 0-1 V range to TP1. Adjust T12 for a dip.

5.4.3 FIRST TRIPLER

Attach a DC voltmeter set for the 0-2 V range to TP2. Adjust T13 for a maximum reading. Readjust T12 and T13 alternately for a maximum reading. Then adjust T14 for a dip.

5.4.4 SECOND DOUBLER

Attach a DC voltmeter set for the 0-2 V range to TP3. Adjust T15 for a maximum reading. Readjust T14, T15 alternately for a maximum reading. Then adjust T16 for a dip.

5.4.5 SECOND TRIPLER

Attach a DC voltmeter set for the 0-2 range to TP4. Adjust T17 for a maximum reading. Readjust T16, T17 alternately for a maximum reading.

5.4.6 PRE-DRIVER

Attach a DC voltmeter set for the 0-1 V range to TP5. Adjust TC10 first for a maximum reading and then TC9. Readjust TC9, TC10 alternately for a maximum reading.

5.4.7 DRIVER

Adjust TC11 for maximum current draw as observed on the power supply ammeter. Then TC12 for maximum current draw.

5.4.8 FINAL

Adjust TC13 for maximum power output as observed on the wattmeter.

5.4.9 FREQUENCY ADJUSTMENT

To set transmit frequency, adjust the trimmer (TC5 through TC8) for the corresponding channel.

5.4.10 DEVIATION ADJUSTMENT

Set the Audio Generator output for about 10 mV output at 1 KHz. Adjust VR3 to produce 5 KHz of deviation. Reduce the attenuator setting by 20dB and sweep the generator from 300 Hz to 6000 Hz. If the deviation exceeds 5 KHz at any point, readjust VR3. At 6000 Hz the deviation should be less than 1.25 KHz.

5-5 TRANSMITTER PERFORMANCE TEST

5.5.1 POWER OUTPUT AND FREQUENCY VERSUS POWER SUPPLY VOLTAGE

1. While keying the unit, vary the power supply voltage from 9 to 12 volt. The output frequency should not change.
2. The LED Battery Indicator should go out when voltage is reduced below 9 volts.
3. The transmitter power output should not drop more than one half when voltage is reduced to 9 volts.

5.5.2 SPURIOUS AND HARMONIC MEASUREMENTS

1. Connect the unit to a spectrum analyzer through an in-line 30dB power attenuator.
2. Set the analyzer for 100 MHz per division, 3 MHz resolution. The input attenuator of the analyzer should be set to the proper level. Key the unit to transmit. All spurious emissions and harmonics should be better than 60dB below the carrier.

5.5.3 ANTENNA TEST

1. Connect an antenna to J1. When held in the hand, in the normal vertical position, the unit should draw approximately the same current as on a dummy load. If not, antenna length will need to be adjusted.
2. Disconnect the unit from the test jig and reassemble it back into its case. Insert a fully charged battery pack and recheck deviation, frequencies, power output and spurious and harmonic radiation.

SECTION 6 - PARTS LIST

SYMB.	SPEC.	NOTE
TRANSISTORS		
Q 1	SRF2817K	
Q 2	SRF2817K	
Q 3	SPS147-6	
Q 4	SPS157-9	
Q 5	SPS952-2	
Q 6	MPS147-6	
Q 7	MPS3866A	
Q 8	SPS952-2	
Q 9	SPS952-2	
Q10	SPS952-2	
Q11	SPS147-6	
Q12	SPS147-6	
Q13	SPS147-6	
Q14	SPS811	
Q15	SRF2819K	
Q16	SRF2818K	
Q17	SRF2442K	
Q18	SPS852-2	
Q19	SPS952-2	
Q20	SPS952-2	
Q21	MPSA55	
INTEGRATED CIRCUITS		
IC1	MC3357 P-1	
IC2	LM386 N-1	
DIODES		
D 1	IN4148	
D 2	Zener IN757A	
D 3	IN4148	
D 4	BA284	
D 5	IN4001	
D 6	IN4148	
D 7	IN4148	
D 8	Zener IN753A	
D 9	Zener IN753A	
D10	L.E.D. TIL209A	
D11	IN4001	
CAPACITORS	Note: T - Tantalum Solid Cap C - Ceramic	SM - Silver Mica M - Mylar
C 1	10P	SM
C 2	.01	C
C 3	4.7	T
C 4	47P NPO	C
C 5	20P	SM
C 6	.001	C
C 7	15P NPO	C

SYMB.	SPEC.	NOTE
C 8	.001	C
C 9	22P NPO	C
C10	.01	C
C11	.01	C
C12	.01	C
C13	4.7	T
C14	.01	C
C15	15P SL	C
C16	1.0	T
C17	.1	C
C18	39P NPO	C
C19	47P NPO	C
C20	100P N220	C
C21	.1	T
C22	.1	T
C23	10P NPO	C
C24	.02	M
C25	.1	T
C26	470P	C
C27	470P	C
C28	1.0	T
C29	10	T
C30	.02	C
C31	.01	C
C32	47	T
C33	1.0	T
C34	.001	C
C35	.0033	M
C36	.001	C
C37	1.0	T
C38	47	T
C39	47	T
C40	.001	C
C41	15P NPO	C
C42	56P	SM
C43	none	
C44	56P	SM
C45	none	
C46	56P	SM
C47	10P N470	C
C48	56P	SM
C49	.001	C
C50	56P N750	C
C51	220P N750	C
C52	.01	C
C53	15P NPO	C
C54	27P NPO	C
C55	100P	C
C56	none	
C57	33P	SM
C58	none	
C59	33P	SM
C60	5P N470	C
C61	33P	SM
C62	47P NPO	C
C63	33P	SM

SYMB.	SPEC.	NOTE
C64	.001	C
C65	220P N750	C
C66	56P N750	C
C67	47P NPO	C
C68	82P	SM
C69	82P	SM
C70	.01	C
C71	.01	C
C72	none	
C73	4.7	T
C74	39P NPO	C
C75	.01	C
C76	2P NPO	C
C77	39P NPO	C
C78	.01	C
C79	.01	C
C80	33P NPO	C
C81	.01	C
C82	2P NPO	C
C83	27P NPO	C
C84	.01	C
C85	10P	SM
C86	.001	C
C87	1P NPO	C
C88	5P	SM
C89	.001	C
C90	50P	SM
C91	47P	C
C92	4.7	T
C93	50P	Mono
C94	1P	SM
C95	none	
C96	none	
C97	3P	SM
C98	50P	SM
C99	non	
C100	5oP	SM
C101	.001	C
C102	.001	C
C103	4.7	T
C104	none	
C105	10P	SM
C106	4.7	t
C107	50P	SM
C108	27P NPO	Mono
C109	50P	SM
C110	4.7	T
C111	.01	C
C112	none	
C113	5P	SM
C114	5P	SM
C115	10P	SM
C116	15P	C
C117	47P	C

SYMB.	SPEC.	NOTE
C118	10P NPO	C
C119	3P	SM
C120	5P	SM
C121	39P NPO	C
C122	4.7	T
C123	.001	C
C124	.1	T
C125	.001	C
C126	4.7	T
C127	4.7	T
C128	.15	T
C129	4.7	T
C130	470P	C
C131	.001	C
C132	none	
C133	47	T
C134	47P	C
C135	47P	C
C136	.001	C
C137	47P	C
C138	5P	SM
C139	10P	SM
C140	47P	C
C141	.15	T
C142	7P NPO	C
C143	47P	C

TRIMMER CAPACITORS

TC 1	20P
TC 2	20P
TC 3	20P
TC 4	20P
TC 5	20P
TC 6	20P
TC 7	20P
TC 8	20P
TC 9	10P
TC10	10P
TC11	10P
TC12	20P
TC13	10P

RESISTORS Note: cc - carbon composition only

R 1	4.7K	¼ watt
R 2	22K	"
R 3	22	"
R 4	470K	"
R 5	5.6K	"
R 6	33K	"
R 7	1.5K	"
R 8	220	"
R 9	470	"

SYMB.	SPEC.	NOTE	
R10	18K	1/4 watt	
R11	33K	"	
R12	1.5K	"	
R13	220K	1/8 watt	
R14	10K	"	
R15	10K	"	
R16	220K	"	
R17	2.2K	"	
R18	2.2K	"	
R19	47K	"	
R20	47K	1/4 watt	
R21	27K	"	
R22	10K	"	
R23	10K	1/8 watt	
R24	none		
R25	2.2K	1/4 watt	
R26	470	"	
R27	1K	"	
R28	10	"	
R29	10K	"	
R30	1K	"	
R31	10K	"	
R32	4.7K	"	
R33	560	"	
R34	4.7K	"	
R35	33K	"	
R36	220	"	
R37	1K	"	
R38	22	"	
R39	2.2K	"	
R40	22	"	
R41	10K	"	
R42	10K	"	
R43	560	"	
R44	4.7K	"	
R45	10K	"	
R46	100	"	
R47	820	"	
R48	1K	"	
R49	56	"	
R50	5.6K	"	
R51	33K	"	
R52	100	"	
R53	100	"	
R54	100	"	
R55	22	1/8 watt	
R56	100	1/4 watt	
R57	22	"	CC
R58	22	1/8 watt	
R59	22	1/4 watt	
R60	10	1/8 watt	CC
R61	10	1/4 watt	CC
R62	100	1/8 watt	CC
R63	5	1/4 watt	CC

SYMB.		SPEC.	NOTE
R64		22	1/8 watt CC
R65		1K	1/4 watt CC
R66		2.2K	" CC
R67		2.2K	"
R68		1K	"
R69		56K	"
R70		1K	"
R71		56K	"
R72		1.8K	"
R73		5.6K	"
R74		12K	"
R75		5.6K	"
R76		4.7K	"
R77		none	
R78		220K	"
R79		3.3K	"
R80		100	"
R81		4.7K	"
R82		100	" CC
R83		470	" CC
R84		1K	" CC
R85		470	" CC
R86		1.5K	1/8 watt
VR-1	Pot	20K	(A) Volume
VR-2	Pot	5K	(B) Squelch
VR-3	Trim Pot	50K	Deviation
TH-1	Thermistor	500	
TH-2	"	"	
T-1	Helical Resonator		
T-2	"		
T-3	"		
T-4	"		
T-5	Transformer		L-2665
T-6	"		L-2665
T-7	"		L-2665
T-8	"		L-2657
T-9	"		L-2661
T-10	Helical Resonator		
T-11	"		
T-12	Transformer		L-2662
T-13	"		L-2663
T-14	"		L-2664
T-15	"		L-2665
T-16	"		L-2666
T-17	"		L-2667
L-1	Air wound		L-2660
L-2	"		1/2 turn
L-3	"		"
L-4	Choke-Coil		L-2656
L-5	Air wound		L-2658
L-6	"		L-2660

SYMB.		SPEC.	NOTE
L- 7	Air wound		L-2658
L- 8	Choke-Coil		L-2656
L- 9	Air wound		L-2658
L-10	"		L-2656
L-11	"		L-2659
L-12	"		L-2660
L-13	"		L-2659
CH-1	RFC		22MH
S-1	Rotary Switch		
S-2	Micro Switch		
S-3	Part of VR1		
J-1	BNC Female Conn		
J-2	none		
J-3	6 Pin Female Conn		
LS-1	Speaker	8 ohm	2 watts
MK-1	Mic Element	2K	Impedance
CFL-1		CFM-455-K	
YFL-1		21.4 Meg Hz	
Y-1	Crystal	1st Local Osc	
Y-2	"	"	
Y-3	"	"	
Y-4	"	"	
Y-5	"	Xmitter Fundamental	
Y-6	"	"	
Y-7	"	"	
Y-8	"	"	
Y-9	"	2nd Local Osc 20.945 Meg Hz	

NAME	PART NUMBER
Front Case	1411-1810-356
Rear Case	1411-1810-357
Push-to-talk	1411-1810-359
Spring - Push-to-talk	2513-3810-343
Nameplate	2509-3284-000
PC-23 Mounting Bracket	1400-3810-606
Heatsink	5400-1810-609
W shield	2508-3810-608
L shield	2508-3810-607
Knob, Volume & Squelch	2402-0854-640
Knob, Channel Selector	2402-0854-440
Control Mounting Bracket	1400-5810-312
RF shield	2508-3810-613
Coil shield 7mm	2508-1810-620
Hex nut	5450-0808-442
90° pin receptacle	2105-0860-903
PCB pin	2105-0860-803
Straight pin receptacle	2105-0860-905
Battery cover	1411-1810-358

NAME	PART NUMBER
Battery Spring RH	2513-3810-344
Battery Spring LH	2513-3810-345
Latch Head	1420-5810-320
Latch Detent	1420-5810-332
Filter shield	2508-3810-611
Flat shield	2508-3810-610
Faceplate	2403-5810-612
PC-23 Bd	1700-1810-618
Sub-Panel	1405-5810-605
Bottom Plate	1411-1810-362
Rear case screw	2801-0863-960
Top/bottom case screw	2803-0864-120
Whip Antenna	MA-197
Stub Antenna	MA-198

When ordering parts, specify symbol, name, spec. and 11 digit part number.